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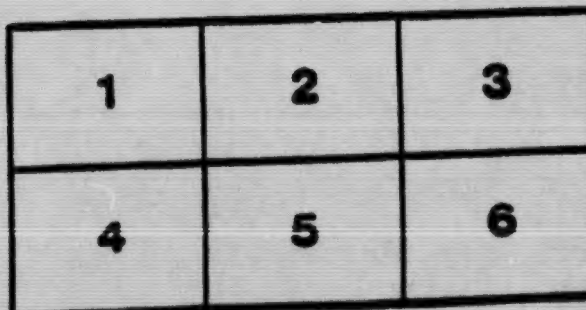
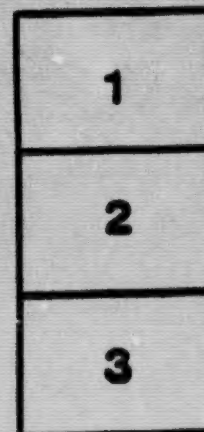
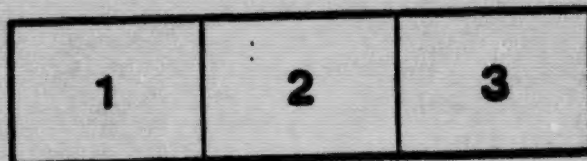
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1894/1895

Geological Exploration Along the Northern and Western Railway

31/ **REPORT**

OF

JAMES P. HOWLEY, F.G.S.
for the Year 1894.

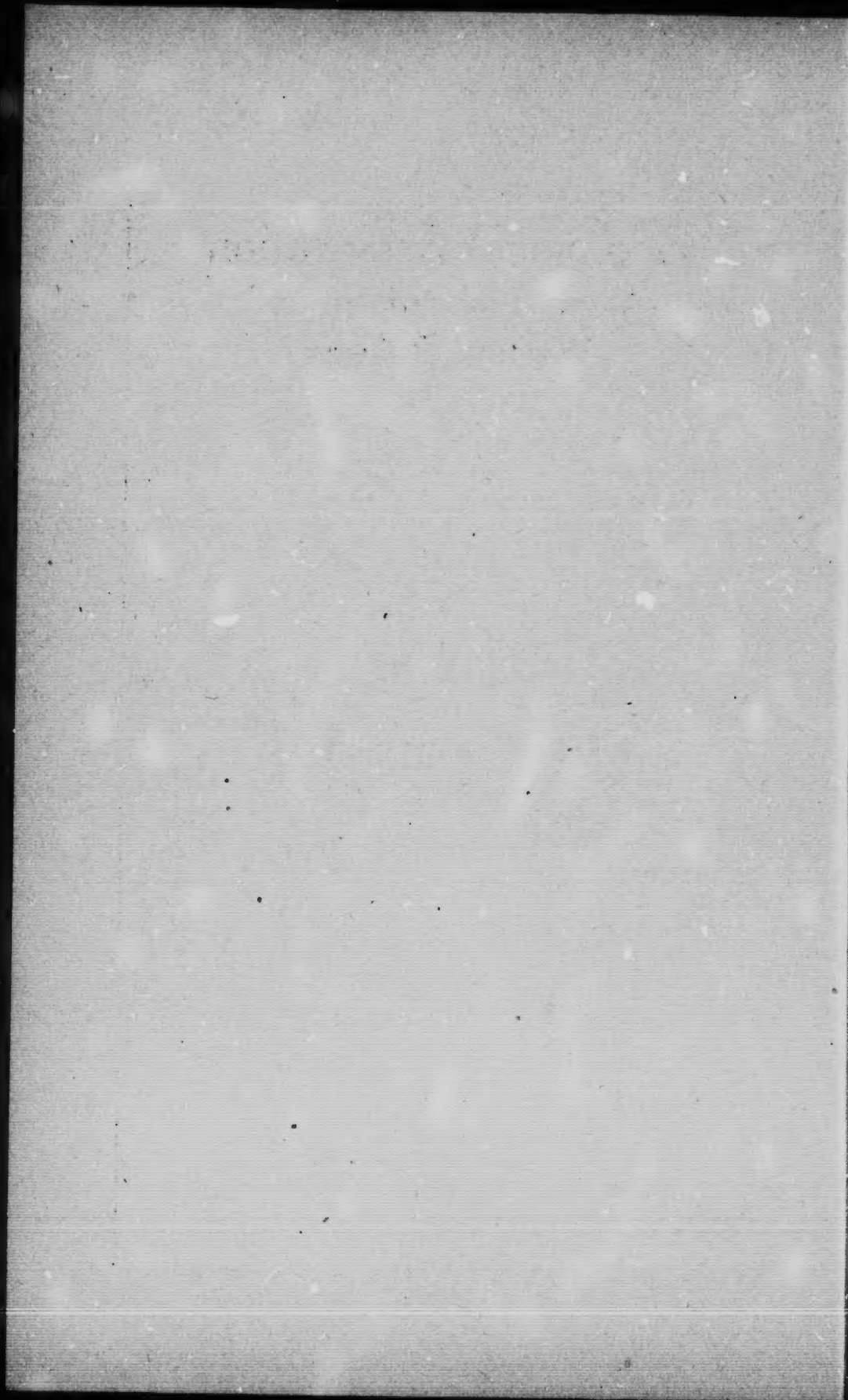
ST. JOHN'S, N.F.
Robinson & Company, Limited, Press
1917

R. J. Sanders-Sly

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REPORT

ON THE

Geological Exploration along the Northern and Western Railway, by James P Howley, F.G.S., for the Year 1894.

St. John's,
March 20th, 1895.

The Hon. Surveyor General,—

SIR,—I have the honor to submit, for the information of the Government, the following report of last season's operations of the Geological Survey.

As you are no doubt aware, owing to the delay in passing the necessary appropriations for the public service, consequent upon the political events which took place last spring, the season was far advanced before anything definite could be arranged as to the field-work of the survey.

The continuation of the coal-boring operations of the previous season in the central carboniferous area would have been advisable, had not the time now at our disposal been so restricted as to preclude the possibility of effecting much work of a valuable character. Under these circumstances it was deemed advisable to allow the coal-boring to remain over till another year. A suggestion was made to the Government that the staff of the survey be utilized for the short time remaining in an exploration along the route of the Northern and Western Railroad. It was urged that, owing to the facilities afforded by the railway for moving about, much more ground could be covered in the short space of time still available than otherwise. The numerous rock-cuts along the route would furnish valuable clues to the geological formations intersected thereby, and, in fact, form a key to the structure of a great portion of the island.

Should any of these formations in the vicinity of the railroad afford indications of possessing minerals of value, the mapping out of such area as a guide to the prospector was deemed a matter of no small importance to the future success of that enterprise.

The locating of lands suitable for agricultural settlement,

which should also form part of the season's exploration, was in itself a matter of much moment.

The Government having signified its approval of these suggestions, preparations were immediately made to carry them into effect. On the 20th of August our party started by train for Shoal Harbor, head of Smith's Sound, Trinity Bay—this being considered a convenient point from whence to commence the exploration. An examination of the immediate vicinity was begun right away, and extended along the railway route north and south, as well as over the surrounding country. While encamped here, the occasion was availed of to visit the head of Trinity Bay and examine a small valley said to contain good land, extending southward from Chapel Arm towards the junction of the Northern with the Placentia line of railway. A report upon the character of this valley was immediately forwarded, as requested, to the Acting Colonial Secretary.

The line between the junction and Come-By-Chance was traversed partly on foot and partly by rail. In the meantime, Mr. Bayly and party had explored and surveyed that portion between Come-by-Chance and Shoal Harbor.

On my return to the latter place, an examination was made of the western part of Random Island and the shores of Smith's Sound as far as Smith Point, and a section of the Cambrian series, which constitutes the underlying rock formation of this part of the country carefully measured. This section, from a scientific point of view, was one of great interest. The shales and limestones of which it is composed are crowded with organic remains peculiar to this ancient series, a number of which were collected. Since our return home, these fossils have all been submitted for identification to Mr. G. F. Matthew, F.R.G.S., of New Brunswick, who is a noted authority upon the peculiar fauna of this particular period. Mr. Matthew has on this, as on several previous occasions, most obligingly examined, named and returned the specimens. While rendering these valuable services gratis to our survey, he has been chiefly actuated by a love of science and a desire to acquire all additional information upon this particular geological horizon, the study of which he has made a specialty. We next moved to Clode Sound, from whence the country north and south along the railway, and

the shores of the Sound as far as the Narrows were carefully examined.

On arriving at Terra Nova River a stay of several days was made, during which time the surrounding country was explored and the river ascended for several miles above Terra Nova Lake. George's Pond, to the west of the former, was also visited.

Maccles Pond, a large lake situated about midway between Terra Nova River and Gambo, was explored in canoe, and the country around traversed on foot in various directions.

A week was spent at Gambo. The river and lakes were ascended some twenty miles, and the railway line traversed each way from Maccles Lake to Suley's Brook, flowing into the east end of Gander Lake, close attention being directed to the geological and other features of all the intervening country.

While camped at Glenwood, at the crossing of the main Gander River, the great lake was visited and the two large inflowing rivers were ascended for several miles. A journey was made to Mount Peyton to the west of the lake, and the railway route east and west was carefully examined.

By this time the season was growing late, and the prospect of being prevented by bad weather from visiting and examining the high land near the end of the track being highly probable should we leave it much longer, we therefore concluded to move right on to head-quarters and work backward. We found the cars situated near Mary March's River, a tributary of the Exploits flowing into the N. E. Arm of Red Indian Lake.

From here to the height of land and for several miles around, and along the line eastward, the country was traversed on foot, and when the cars were moved further on to the neighborhood of the Gaff Topsail, beyond the summit level, Mr. Reid very kindly took us up with all our camp equipage and transported us thither. By that time the irons were laid about six miles beyond this point. After our examination of the surrounding country, an expedition was undertaken to the Grand Lake on the Humber Valley, for the purpose of enquiring into the alleged report of new coal finds, and also to ascertain the condition of the boring apparatus for future operations in this region.

During the summer various rumours had reached us relative

to large seams of coal having been discovered on Grand Lake other than those already uncovered by our explorations of previous seasons, and to test the same Mr. Reid had obtained the use of the diamond drill from the Government. Having entertained a doubt, amounting almost to a certainty, that the alleged find was a false rumour, the doubt was confirmed upon meeting Mr. Reid, from whom I learned they had been boring on the north side of the lake near the outlet of Junction Brook, and had not succeeded in striking any coal. To any person having the least knowledge of the geological structure, or at all conversant with the character of the different members of the carboniferous series, this would not be a matter of surprise. The north side of the lake is occupied by the lower carboniferous formations only, at a horizon many thousand feet below the productive coal measures. Upon learning these facts, I recommended Mr. Reid to try at several points on the south side of the lake, where the prospects of finding coal were at least probable.

On arriving at Grand Lake we found the boring party camped near the mouth of Coal Brook, one of the points recommended. They had sunk a pit through the gravel and sand some eighteen feet till they struck the bed rock preparatory to commencing boring here. The rock was a fine-grained, finely-micaceous, greenish-gray sandstone, apparently belonging to the true coal measures. It would have been interesting had they succeeded in boring in this locality, as there was certainly a prospect of striking coal. It was lower down in the section than the position of any of the seams previously uncovered, and were it proved that it existed in this lower horizon, the increased value and importance of the coal measures here would thereby have been greatly enhanced. We were afterwards informed that they abandoned the attempt without any effort at boring at all. Where they had bored on the north side of the lake a depth of 105 feet had been attained, chiefly through coarse, red sandstone and grit, either belonging to the carboniferous limestone or base of the millstone grit formation. What could have induced Mr. Reid to expend time and money upon such a useless undertaking I fail to comprehend, when the least enquiry as to the prospects of finding coal in this particular part of the series would have at once convinced him of its futility.

On our return from Grand Lake we began to work eastward again. Moving first back to Joe Gload's Pond, the country east and west from here was explored; we then moved to Badger River at its junction with the Exploits and having examined the country along the line either way and up the main Exploits River for several miles, it was now time to abandon the work and return home. We arrived in St. John's by rail on Nov. 6th. The season had been favourable for exploration all through. It was comparatively free from wet, broken weather, and the oppressive heat was pretty well over before we set out.

To the great kindness of the Messrs. Reid we are particularly indebted in affording us every facility for moving back and forth along the line whenever opportunity offered. We also found the train hands, as a rule, most obliging on every occasion. We were thus enabled to get over an immense area of country which, under other circumstances, would have taken years of hard labor to accomplish. Our examination was, of course, a very cursory one, and was more particularly directed to the immediate vicinity of the line. Since returning home, the result of the season's work has been mapped out and the various rock formations distinguished thereon by suitable colors. The lands adapted for cultivation are colored green on plan, and large sections of these, showing how they may be best laid off for settlement, are now furnished with this report.

GENERAL FEATURES OF THE COUNTRY.

In order to render this portion of the subject more specific, I shall divide the route into sections, beginning at the junction of the Northern with the Placentia line, or where the Northern and Western line branches off, which is about seven miles beyond Whitbourne. The first section, extending from here to Come-By-Chance, runs through the narrow neck of land separating Placentia from Trinity Bay known generally as the Isthmus of Avalon, though, more properly speaking, the isthmus is the narrowest portion of this neck dividing Come-By-Chance water from that of Bay Bulls Arm. This section undoubtedly possesses the least value of any along the entire route. It is broken, hilly, barren and rugged throughout—the surface, for the most part, being covered only with a thin, gravelly soil encumbered with numerous boulders, and supporting

here and there very scant patches of stunted timber or mere scrub. The bare rock protrudes through the superficial drift in many places, giving rise to short, irregular ridges, divided by narrow, crooked ravines, which left but little room for choice in the location of the line; hence the numerous short, sharp curves, high gradients, and the many heavy cuts and fills found here. In the vicinity of Rantem, in particular, this broken character of the country is extreme.

The district is not, however, entirely destitute of natural resources. Mention has already been made of a small valley extending northward from the junction to Chapel Arm, Trinity Bay, where the soil is of excellent quality and adapted to a high state of cultivation. The valley is well wooded throughout, and were it opened up, as recommended, by a good road with suitable-sized lots laid off on either side, it might be readily availed of for settlement. The uplands also in its vicinity, and for several miles around, would afford good grazing for quite a number of cattle and sheep during the summer months.

The second section extends from Come-By-Chance to Shoal Harbor, head of Random Sound, Trinity Bay. After leaving Come-By-Chance and entering upon the main body of the island, the line strikes more land, but on approaching Random Sound it again comes out to the coast and reaches the water's edge at Shoal Harbor. This section is very varied in character. At first it runs up the valley of Come-By-Chance River about seven miles. This valley is well wooded and the soil fairly good, especially on the bottom lands. Much of the latter appears to be adapted for cultivation. The clearings near the head of Come-By-Chance inlet show pretty clearly what the character of the soil is. A family named Adams have quite an extensive farm here, and keep a large stock of cattle, &c. Were this valley opened up by a road running through it in a similar manner to that recommended for Chapel Arm Valley, to connect with the railway line, I see no reason why an industrious population might not form a successful settlement therein.

After leaving Come-By-Chance Valley the country again becomes rugged and barren, covered only with scanty timber and much peaty soil, interspersed with bare ridges and numerous ponds.

Towards the head of Random Sound it is very rugged, the hill-ranges running out of the water side are cut up by deep ravines, through which flow considerable streams. Upper and Lower Shoal Harbor, as well as Clarenville, are thriving settlements. Although the soil is not very good, still the clearings of the settlers here afford them a good stock of vegetables and hay for their cattle. On Random Island, opposite Shoal Harbor, and again down along the north side of Smith's Sound, the country partakes of a very much better character. The soil, for the most part, is much superior to any yet seen. This district of country has been frequently reported upon, especially in the years 1869-70. In the latter report it was shown that, owing to the manner in which these lands were being squatted upon and the absence of any systematic plan of settlement, all the frontage was being occupied without leaving any reserves for roads; consequently the lands in the rear were rendered inaccessible, and it was strongly urged that something should be done to remedy this evil ere it was too late. During the present season another equally reprehensible practice was brought under my notice by some of the settlers, viz.: that certain parties had succeeded in obtaining grants, or otherwise claimed, all the available land fronting on the shore without apparently any intention of clearing or occupying the same—thereby shutting out many would-be settlers who were desirous of going into the cultivation of the land. These and other similar draw-backs have been the means of effectually precluding settlement on any extensive scale, and it appears to me a matter well worthy the attention of the Government to remove, if possible, all such barriers. There can be no question were such action to take place, and were the rear lands rendered accessible by roads leading from the shore at suitable points, this fine tract of country would soon be occupied. A little industry on the part of the settlers would, in course of a short time, render it a thriving and prosperous locality. The facilities which the Northern and Western Railway now offers for marketing surplus produce could not fail to prove a great incentive to the utilization of all the ground capable of cultivation. The timber trade, fisheries, slate quarries, brick-making, lime-burning, &c., with possibly other industries likely to spring up in this favoured locality, could scarcely fail in time to add greatly to the prosperity of the inhabitants, and render their position a highly satisfactory one.

The third section extending from Shoal Harbor to the head of Clode Sound, passes up through a picturesque gorge forming the narrow valley of Shoal Harbor River. The hill-ranges rise very steeply on either side of the gorge, but especially on the western side, where perpendicular cliffs form a wall-like parapet for several miles. Emerging from this gorge and crossing the river, the line comes out upon a more open country, fairly well wooded, and skirts around a pretty sheet of water called Thorburn Lake. The outlet from this lake flows in a small, rugged and short stream into the Southwest River of Clode Sound. The line now follows the valley of the latter on its south side down to the mouth of the river, which is crossed by a magnificent iron bridge resting upon solid granite piers, having two spans of 125 feet each. Thence it winds around the head of the Sound to Port Blandford, where a long pier some 700 feet is constructed, out to a deep water terminus, where large steamers can load and unload with ease. This section of the line is for the most part well wooded, except where fire has denuded the forest, as in the vicinity of Shoal Harbor and Clode Sound. In each case fearful devastation of fine timber has taken place, and large areas of country are swept clean. At Shoal Harbor much property, including several of the settlers' houses and the Methodist church, were demolished in 1892. There appears to be a very extensive tract of green timber of fair size still available further up the valley of Shoal Harbor River and to the westward of Thorburn Lake, also on the upper portion of the S. W. River of Clode Sound. The entire country around the head of Clode Sound and for many miles back has been overrun by the fiery element several times in succession. There is not much land fit for cultivation on this section. Some small patches along the margin of Shoal Harbor River would if cleared yield good hay crops; again near Thorburn Lake there is some fairly good soil. Much of the land along the lower reaches of S. W. River and around the head of Clode Sound might be reclaimed to advantage. The soil here is light and sandy and would require much manure, but I believe is capable of yielding fairly good crops. The importance of this place as a shipping port has already been recognized by the Messrs. Reid, who have frequently loaded and unloaded large steamers at the pier here. All the lumber from Suley's Brook and Glenwood mills has been ship-

ped from here the past season, and several cargoes of coal, railway iron and other requisites for the construction of the N. and W. line landed. The bold, deep water of the Sound, and its freedom from dangerous rocks or shoals, renders it a most advantageous point for such purposes. One can scarcely fail to be struck with the admirable situation of this place as a most desirable one for a town site; and in view of future progress, Clode Sound is certainly destined to become a place of much importance.

The next section, extending from Clode Sound to Terra Nova River, is a short one. Following up the valley of the N. W. River, the line crosses it about two miles above its outlet and then takes a northerly direction till near Pitts' Pond, the western side of which is followed to its foot, where the water flows out into the Terra Nova River. This latter is crossed just at the foot of the long steady below Terra Nova Lake by a fine, iron bridge of two spans. Here, near the bridge, the Campbell Lumber Company have a fine establishment, including a large, well-equipped saw-mill. Most of the timbered areas between Clode Sound and Terra Nova River have been swept by fire, and the country presents a very uninviting appearance. There is, however, a considerable area of light, sandy soil along the slope towards Pitts' Pond worth cultivating. The shores of Terra Nova Lake and the valley above are pretty generally wooded, and there are extensive flats along the river side covered with a dense growth of wild grass. These, with a little judicious drainage, could be converted into good hay meadows, the periodic inundations of the river being sufficient to keep them in fertility. The next section extends from Terra Nova River to Gambo, head of Freshwater Bay. The country along this section is, for the most part, rugged, and has been greatly denuded by fire. About midway between these two points a large lake, Maccles Pond, occurs. The line trends around its eastern end. The timber in the vicinity of this lake has all been destroyed, and the country now presents a very bleak aspect. Towards Gambo it improves considerably and there is still a large area of well-wooded country. Some very good patches of land occur on this portion of the line on the slope towards Gambo Valley. Near the latter river extensive marshes occur. A fine, iron bridge spans the river. The valley of the Gambo River has been in late years denuded of much of its

timber, owing to extensive milling operations and having been partly swept by fire; still there is much available timber on the upper reaches, and Mr. John Murphy is doing quite an extensive lumber trade. His fine mill at Mint Brook affords remunerative employment to a number of people, who have made quite a thriving little settlement here. Mr. Murphy has recently, since the advent of the railway, erected a large hotel near the mouth of the Gambo River, which is fitted up with offices, stores, and rooms for the accommodation of travellers by the line on an extensive scale. It is quite a handsome building, and very conveniently situated for a station-house.

There is a good deal of land available for cultivation around the Gambo Lakes and up the valley of Triton River, flowing into the upper lake. Between Gambo and Suley's Brook, near the eastern end of the Gander Lake, the country is varied, being rather broken and hilly, though not rugged, and there are extensive lakes, especially upon the Middle Brook of Freshwater Bay. Nearly all this tract has been despoiled of its timber by fire, but a young, vigorous growth, chiefly of birch, is rapidly taking the place of that destroyed. Near the head of Gander Lake the country is again more or less marshy and barren but towards Suley's Brook it becomes well wooded. The Messrs. Reid, the contractors of the line, have established a splendid mill here at Benton, and are pushing forward their lumbering business with great vigour. Last season, as I understand, they disposed of all their lumber to advantage. Most of this was shipped to England *via* Clode Sound. This mill is one of the best equipped in the island. There is little land available for cultivation along this section, except a few small patches. From Suley's Brook to the crossing of the main Gander River the line runs very straight for a long distance; there is one tangent of over seven miles—I believe the longest on the entire line. Extensive marshes occur on this section, but towards the shore of Gander Lake there is a good deal of timber. Mr. Sterritt has a fine, new saw-mill at Glenwood, just at the crossing of the Gander, and quite a nice, little settlement is springing up here. The lumbering operations carried on at Glenwood have been begun but a short time since, and give promise of developing into a thriving industry ere long. Already several cargoes have been shipped to the English

market via Clode Sound, and the timber produced here is said to be some of the best from the island. Gander Lake region will afford an abundant supply for many years to come. This beautiful sheet of water possesses many attractions, is well timbered all around, and the soil in many parts, but especially on the islands and intervals along the main inflowing rivers, is of excellent quality. It would be an admirable place to form a settlement. A large portion of the country above the lake had been swept by fire many years ago, but is being rapidly re-occupied by a young and vigorous growth of timber. The scenery around Gander Lake is of a very picturesque character, and no doubt will soon be a source of attraction to tourists when it becomes more generally known.

From Gander River to Norris Arm, Bay of Exploits, the country is again much varied. Numerous lakes occur, and timber of fair size is pretty well distributed, though here again fire has produced much havoc. There are several patches of nice land along this section. At Norris Arm and along the estuary of the Exploits the country is very attractive. It is all well wooded, and has a fairly good soil. Extensive settlement has taken place here within the last half dozen years. The establishment of the saw-mill at Botwood and the large lumbering operations now carried on in the Exploits Valley, with the advent of the railway, has given an impetus to the settlement of this district which is destined ere long to be one of the most flourishing parts of the island. It is a pity the idea of aiding settlement in this favoured locality, as proposed by an Act of the Legislature of 1886, had not been carried into effect. In that year the lands all along the estuary from Northern Arm up to the head of navigation, including Peter's Arm, Burnt Arm and Norris Arm, were all laid off in convenient-sized lots, and staked out so as to give every lot a frontage on the water side, with ample road allowances to the lands in the rear.

It was proposed by the then Government to assist any *bona fide* settler who would give satisfactory evidence of his intention to enter upon the cultivation of the soil, either as a sole means of livelihood or as an auxiliary employment to the fisheries, and to further stimulate agriculture in such settlement a bonus of twenty dollars for each of the first five acres cleared and cropped, and ten dollars for each succeeding acre up to ten acres, was to be given.

Roads were also to be constructed through the district, in the making of which the settlers were to be employed. The Act was a good one and it is doubtful if any country in the world offered anything like such inducement to settle on its wild lands. This district being so admirably situated in every respect for trying the experiment was selected and laid off as mentioned above but here the whole thing seems to have ended, and up to the present time nothing further has been done in the matter. That the land is of good quality and capable of yielding excellent crops has been amply verified long since by the settlers who have made their homes here, all of whom are in prosperous circumstances. There is no reason whatever why a much larger number should not succeed in the same manner, if only industry and perseverance were brought to bear. The facilities the railway now affords for reaching the markets on the eastern coast should be a great inducement to settlement. There are few more favored localities in the island. A very few years should suffice to render it one of the most prosperous localities in Newfoundland. Norris Arm is at present the terminus of the subsidized portion of the Northern and Western Railroad, and also the principal point for the accommodation of mail and passenger traffic for the whole of the immense district of Notre Dame Bay. The Messrs. Reid have erected an hotel and station-house here, also a wharf for landing coal, iron, and other requisites for the construction of the railway. After leaving Norris Arm the line now runs up the valley of the Exploits, following the south side of the river to Bishops' Fall, where it is spanned by a magnificent iron bridge, probably as fine a one of its kind as any in North America. It has three spans supported upon solid granite piers. One span is 200 feet long, the others about 150 feet each. Altogether, it is a splendid piece of workmanship, and gives ample evidence of the thorough manner in which the Messrs. Reid are carrying out their contract. Having crossed the river the line continues along the north side, passing inside the Grand Fall and coming out occasionally to the river's bank beyond. It crosses the Badger at its confluence with the Exploits forty-five miles from the mouth of the latter. Here, again, there is a fine, iron bridge of substantial structure. Along this section the line is tolerably level with very easy gradients. Fine has again, within a very few years past, laid waste a vast area of the country on the lower valley of the Exploits, and an immense

amount of fine timber has been destroyed. Much excellent land occurs along this section, notably near Rushy Pond and towards the Badger Brook. The scenery on the Exploits River is very picturesque, numerous glimpses of which are had from the passing train. The confluence of the Badger is a pretty spot, and is now selected as a depot for storing provisions, &c., for the lumber-men engaged logging in the surrounding country. This industry has grown rapidly of late years; several hundred men are now employed cutting and driving the logs to the mill at Botwood. At the time of our visit last autumn some \$15,000 worth of supplies were stored at the Badger for winter use. Last season 60,000 pine logs were cut on this valley, and during the present season the drive is expected to reach about 80,000. The lumbering industry, both here and elsewhere, is now thoroughly established on a sound basis. Capital and experience combined are at length rendering our long-neglected timber resources available and it is a matter of congratulation to know that the business is thriving and giving remunerative employment to many of our people. That there is room for it to greatly expand is no longer a matter of doubt. Irrespective of milling and the manufacture of lumber, the business of pulp-making should soon take root here so as to utilize the vast amount of timber not suitable for sawing into lumber which exists in many districts of the island. It is to be hoped that ere long this new industry may be established and thus afford another source of employment for our people. Attention has been over and over again directed to the fearful destruction of our forests by fire, caused in most instances by wilful carelessness or even worse; still there appears to be no remedy applied, and every year sees the area of destruction greatly enlarged.

After leaving the Badger the line strikes west or rather a little north of west, till the valley of Rowsell's River is reached, near Skull Hill. This section, westward from the Badger River as far as Lake Bond, is fairly well wooded, but there are several extensive areas of marsh land after rising out of the valley of the Exploits, some of which marshes yield good crops of wild grass, and are capable of being greatly improved by draining.

Beyond Skull Hill the line trends away southwesterly to avoid the broken, hilly country westward, and, sweeping around again, comes out on the great, open, rolling plain which extends over the

height of land or summit of the Long Range Mountains at this part of their trend. The most southerly part of the great bend is reached at the crossing of Mary March's River. This section of the line crosses several extensive marshes and the country for miles around is but sparsely wooded, except in the vicinity of Joe Gload's Pond, a pretty sheet of water near the 240th mile. Beyond this the timbered areas become more and more restricted. From Mary March's River the line begins to sweep around northward and gradually climbs the central ridge or roof of the country known as the Three Topsail Ridge or White Hill Plains. It takes its name from three remarkable "tolts" lying in a nearly straight line and at about equal distances apart. These conspicuous features of the landscape are supposed to bear some resemblance to the topmasts of a ship when seen from a distance and the names are not inappropriate. The country is exceedingly bare about the height of land and bestrewn with a vast accumulation of boulders of all shapes and sizes. Innumerable lakes and ponds dot the surface for many miles around. No timber, except mere dwarf scrub in isolated patches, exists. Over this great plain, however, many extensive patches of grassy land are met with, and cattle might find ample grazing here in summer time. Mr. Reid informed me that his horses thrive well on this barrens all last summer. Horned cattle and sheep in large numbers would, I imagine, find sufficient provender for at least four months each season on this upland country. The Gaff Topsail, another of those isolated tolts, so named during the preliminary railway survey of 1890, lays westward of the Main and Mizzen Topsails about two miles. From the summit of this latter a depression in the hill-range, away to the northwestward, shows the gap formed by Kitty's Brook, which is the gateway, as it were, to the Humber Valley and the western side of the island. In the vicinity of the Gaff Topsail the country is still barren and boulder-bestrewn but a few miles beyond, or towards the headwaters of the Eastern Branch of Kitty's Brook, timber again begins to assert itself, though of a poor, stunted growth. It, however, improves greatly as the valley is followed downward, and about the junction of the east and south branches and down the main valley there is a good deal of timber suitable for railway ties, fire-wood, &c. The work of construction and laying of the rails had reached to the main crossing of Kitty's Brook when

the season's operations closed, but the right of way had been cut out and cleared of timber down to the crossing of Goose Pond Brook on the Humber Valley. The energy with which the Messrs. Reid are pushing on the work, and the substantial character of the line, is worthy of all praise. There can scarcely be a doubt that the coming season will witness the completion of the line to the West Coast thus uniting the two sides of the island so long isolated from each other. What effect this great undertaking may have upon the future development of the country can only be conjectured as yet. Already it has opened up to commerce a large area of timber which would otherwise scarcely ever have been utilized.

GEOLOGICAL FEATURES OF THE COUNTRY ALONG THE LINE OF ROUTE.

The geology of the Peninsula of Avalon has been pretty well worked out and details given in former reports, especially in those for 1868—72 and —81. The greater portion of the peninsula has been shown to be chiefly occupied by Cambrian and pre-Cambrian rocks. The Intermediate or Huronian of Mr. Murray is by far the most extensive series, being spread out over at least three-fourths of the peninsula. It surrounds a central nucleus of Laurentian age which occupies a position between the east coast and the heads of Conception and St. Mary's Bays. Resting upon these, in the above-mentioned bays, patches of Lower, Middle and Upper Cambrian are met with, unconformably super-imposed, in one case upon both the preceding systems. Still more extensive patches of the Cambrian occur in Trinity and Placentia Bays, where the Lower and Middle portions are well represented. Numerous fossil organisms characterise certain sections of this series in each locality, which have yielded some of the best and most interesting collections of the faunæ of this period in America. The thorough working out of this series in detail would, in a scientific point of view, be looked upon with the greatest possible interest. Nowhere, perhaps, on the American Continent are better or more complete sections exposed than on the shores and islands of our Great Southern and Eastern Bays. Although detached and isolated from each other, the several exposures could, by careful study of their lithological characteristics and fossil contents, afford evidence sufficiently clear to so correlate the different members as to enable the

scientist to construct a complete section of the whole, from its lowest to its highest stratum. This has been accomplished to a considerable extent, yet there are some points of extreme interest not yet worked out, especially in relation to the lower portion of the series and their downward extension. To thoroughly complete this work exclusive attention would have to be given to this particular problem for at least a season or two.

Two or three patches only of the Cambrian came within the scope of last season's exploration. A narrow trough of the red and green slates and impure, red limestone, near the base of the series occupies the valley extending southward from Chapel Arm, Trinity Bay. But small exposures of these were seen and no fossils detected in them. A second narrow trough extends up the valley of Come By-Chance River. This consists of red-brown and greenish-gray slates not well seen. By far the best and most interesting sections were found exposed on the shores of Smith's Sound and on Random Island. Our time would only permit of a very limited examination of these exposures. A careful measurement was, however, made of one interesting section near Smith's Point, and several fossils were collected from this and other parts of the Sound. The section included a large portion of the red and green shales and limestones, which Mr. Matthew believes to be the equivalent of the Etcheminian group of New Brunswick. The grayish shales towards the middle of the section are referred by him to the lower and upper paradoxides zone, or Acadian division, of the St. John Group, while the black shales and thin sandstones at top are referred to the Johannian and Bretonian divisions of the same. The latter, he says, is merely indicated in the section; but as there is a vast accumulation of black shale further along the shore of the Sound, it is highly probable the other members of the group will be fully represented when these come to be closely studied.

The section measured at Smith's Point consists of the following strata in ascending order—the average angle of inclination being about twenty-one degrees, though it varies from nine degrees to forty-six degrees:—

	FT.	IN.
a. Red and greenish slates chiefly dark-red with numerous thin irregular calcareous layers	182	0
b. Band of greenish-gray slate	25	0
c. Red Slate	17	0
d. Bed of nodular-red and flesh-coloured limestone with shaley divisions, obscure fossils	4	0
e. Red slate	13	0
f. Thick bed light-red limestone	5	0
g. Red and green slates, chiefly red, a few thin layers limestone	38	0
h. Band of hard, greenish-gray sandstone	3	0
i. Wide band greenish shale	46	6
j. Red and green shale more red than green	53	6
k. Dark-red calcareous band weathering blackish very heavy, apparently containing a good deal of iron	2	0
l. Greenish and green shale in about equal proportions	57	0
m. Thick bed of hard, gray sandstone; may be a repetition of band h.	8	0
n. Red and green, shaley slate alternating	66	0
o. Greenish-gray slates or shales containing fossils	145	0
p. Band of flesh-red limestone	1	0
q. Greenish-grey shale, darker towards top	30	0
r. Blackish, calcareous band, with peculiar, disk-like markings	10	0
s. Greenish-gray shales with thin, arenaceous layers; numerous fossils	130	0
t. Black, finely laminated shales, with irregular, arenaceous layers much broken and contorted. Numerous fossils	425	0?
	1,251	0

The fossil organisms from this section and from the shales on Random Island having been sent to Mr. G. F. Matthew, of New Brunswick, for identification, have all been named and returned to the Museum. I have elsewhere referred to Mr. Matthew's uniform

kindness in performing this valuable service to our survey not only on this, but on several previous occasions. The list of specimens names are as follows:—

Olenus Cataractus;
 Parabolina c. f. spinulosa;
 Conocephalites or Agraulos;
 Angelina sp?;
 Leperditia?;
 Acrotreta sp. ventral valve;
 Agraulos c. f. Holocephalus;
 Liostracus? c. f. Ouangondianus.

From Kelly's Island—

Lingula Billingsi

From Topsail Head—

Scenella reticulata.

From Manuel's Brook—

Conocoryphe Bufo;

“ trilineata;

Agraulos holocephalus;

Paradoxides abenacus;

“ Tessini;

Erinnys venulosa;

Jingulella c. f. Dawsoni;

Liostracus Ouangondianus;

Agraulos socialis;

Eocystites?.

From Chapel Arm—

Anopolinus venustus;

Liostracus sp. small;

Solenopleura sp. small;

Microdiscus sp.;

Agnostus Lissus?.

Nowhere in Trinity Bay has the Potsdam division as yet been recognized though it is well pronounced at the top of the section of Great Bell Isle in Conception Bay. Mr. Matthew is even inclined to refer some of the Brachiopods from the uppermost strata of that island to the Ordovician (Lower Silurian series).

At the head of Random and Smith's Sounds the Cambrian

series are suddenly disrupted and partly overturned, where they come in contact with a belt of brick-red feldspar porphyry which separates them from an older and more highly metamorphosed series occupying the country inland. In the immediate vicinity of this disturbing element the lower red and green shales and red sandstones are seen, in a low outcrop, striking along the shore. One band of impure, reddish limestone occurs, evidently lower down than any in the section at Smith's Point. At the immediate contact with the porphyry the sandstones become altered to dull-white quartzites and lose much of their original character. One other small, narrow trough of reddish and greenish shales, with a thin bed of limestone was seen in the valley of Shoal Harbor River a short distance inland, apparently of Cambrian age. No other rocks which could be identified either lithologically or otherwise, as referable to the same period were met with anywhere further north or west during the season. The great metamorphosed series occupying the country in the rear of Smith's Sound appear to be spread out over an enormous extent of country. Their contact with the belt of porphyry which separates them from the Cambrian, is not well seen, as the land is low and no rock is exposed for some distance. The first outcrops seen at the head of the Sound and in the railway cuttings present an amorphous mass of more or less dull, greenish colour and fine, close texture. No lines of stratification are visible, but some purplish, irregular bands seem to indicate a sedimentary origin. By far the greater bulk of these rocks have a more or less slaty structure. They vary in color from dark bottle-green to gray and purplish. Sometimes they partake of a brecciated character. The dark-green portion of the mass is more or less chloritic. P.e., yellowish epidote in strings and patches, often resembling lines of stratification, occur at frequent intervals, while some of the purplish bands approach jaspers in hardness. Intermixed with these more slaty rocks in a most confused manner are numerous belts or masses of graywacke, trap, greenstones, felsites, quartz porphyries, volcanic ash-beds or tuffs, &c. A short distance up the valley of Shoal Harbor River a massive, coarsely crystalline gabbro, forming a belt about 100 feet wide, strikes across the railroad track, running in a N. E. and S. W. direction. It appears to be chiefly constituted of dark, bottle-green hornblende with a considerable admixture of feldspar, usual-

ly white, which on the weather surface has become much kaolinized. Some of this decomposed feldspar yields an opaque white or grayish substance, probably saussurite. Accompanying the hornblende, and apparently merged into it, magnetic iron occurs, distinct crystals of which stand out from the mass on the weathered surface. Iron pyrites is also sparsely disseminated in minute crystals. The rock possesses considerable specific gravity, no doubt owing to the large amount of metallic substances contained in it.

The high, precipitous ridge which runs along the western side of the narrow valley of Shoal Harbor River is made up of a set of highly metamorphosed rocks, consisting of peculiar light-colored nacreous flagstones with a rough, slaty cleavage, intersected by belts of dark-colored quartz porphyry. Other portions of this ridge exhibit masses of a flesh-colored brecciated white, weathering rock, apparently a volcanic ash. Towards Thorburn Lake the rock outcrops are chiefly of a chloritic character again, more or less slaty in structure. Hard, dull-colored graywacke with some purplish-colored breccia, apparently interstratified, crop out near the foot of the lake. Strings and patches of epidote characterise all these rocks, and quartz veins, accompanied by pure chlorite, are of frequent occurrence. One of these, cutting a purple breccia near Thorburn Lake, was considerably stained with green carbonate of copper, and contained small strings or nests of a very rich, gray sulphuret of copper (Tetrahedrite).

Just at the outlet from Thorburn Lake a dull, brownish jaspilite forming a wide belt comes in and strikes down the valley of the S. W. River of Clode Sound on its southern side, forming a high, bare ridge. It was traced on the strike out to the south shore of the Sound, where it occupies a considerable stretch of the shore. This jaspilite weathers a rusty brown, has a high specific gravity and in all respects resembles an impure jaspersy iron ore. In many places where water trickles over its surface and lodges in small pools much oxide of iron has accumulated, and the surfaces of the rocks are coated with it. Frequently, also, the overlying gravel deposits are cemented together with the same mineral substances. Whether it contains sufficient metallic iron to render it of commercial value or not has not as yet been ascertained. Specimens have been sent abroad for analysis, but no return has come to hand. This whole series of strata are in such a highly metamorphosed

condition, and their original character so completely changed, that it becomes a matter of exceeding difficulty to place them in their proper geological sequence. Lithologically, they bear no resemblance to the typical Laurentian, nor yet do they possess much in common with the Huronian or intermediate system of Mr. Murray. Moreover, as will presently appear, they are overlain unconformably by strata, having many characteristics of the latter.

Resting upon these in the valley stretching inland from the head of Clode Sound, a much less altered set of sedimentary strata are found. These consist of red and gray silicious sandstones and grits or fine conglomerates, with several arenaceous slaty divisions, bearing a most striking lithological resemblance to the Signal Hill sandstones near St. John's. The greenish-gray sandstones at the base are not so well represented as the redder strata, division f and g. of Mr. Murray's section. Some portions towards the top are more slaty and somewhat micaceous, and would seem to mark an upward extension of the same series not brought in on Signal Hill. The whole stretch across the head of the Sound from the valley of the S. W. River to Salmon River on the northern side, and form a set of wave-like undulations. One or two small greenstone dykes are seen to cut these strata at right angles, but apparently do not cause much extra disturbance. On the northern side of this trough the red sandstones suddenly become more disturbed, are highly tilted and at length distinctly overturned; while at the same time their character has greatly changed, and they become altered to a pale, pinkish quartzite, possessing a remarkably pretty, roseate hue.

A deep depression within a couple of hundred yards of Salmon River Ridge marks the line of contact of this set of rocks with an entirely distinct and much more metamorphosed series. Evidently a fault occurs at this junction, which appears to follow the course of the depression just alluded to. In the bottom of this depression low out-crops of a fine-grained, compact quartzite occur, dipping N. 20, W. angle 66 degrees. These are succeeded by chlorite schists of a dark-green color merging into grayish-purple and pale-yellowish nacreous or talcose slates. The pale-colored bands in particular are highly talcose, exhibiting scales of pure, yellowish-green talc between the layers of stratification, as well as on the surfaces of the cleavage plains. Some of these slates are very fissile, having

a fine, wavy structure. All are greatly disturbed, and several small quartz, epidote and feldspar veins intersect them, especially near the base. Beyond the N. W. River crossing the rock outcrops are not so frequent, yet the same series continue to shew themselves occasionally nearly up to Pitts' Pond, being no doubt frequently repeated by undulations. Nothing similar to the jaspilites south of Clode Sound was observed on this side.

Approaching the Terra Nova River, the country is low and covered with a deep, sandy soil, which effectually conceals the rock formation for a long distance. A belt of coarsely-crystalline pegmatyte granite, about half a mile in width, strikes up and down the river valley, and is well exposed just at the point where the railway bridge spans the river. It consists of several varieties, including some very handsome ornamental rocks. One is a black and white hornblendic syenite, which affords a pretty appearance. Another, composed of large, yellowish-colored crystals of feldspar, white quartz, and a small proportion of black mica, presents a peculiar and most attractive-looking stone when polished, unlike any granite I have previously come across. It might be called a cinnamon granite, from the prevailing yellow color. Flanking this belt of granite on the north, though not seen in actual contact, a bluish graywacke is found dipping S. 16 degrees E., angle 67 degrees. This is in turn overlaid by a dark, bottle-green chlorite schist which, towards the top, becomes very fissile, breaking into fine, flakey particles, and has a very decidedly serpentinous aspect and soapy feel. It might be termed an impure, slaty serpentine. These rocks seem to hold the surface over a considerable area of country, being no doubt frequently repeated by undulations and disturbances, which latter are indicated by the presence of several small, intrusive greenstones and porphyritic dykes, which are seen to intersect them. In some instances these intrusive layers are apparently interstratified with the graywackes. One or two small outcrops of a dull-grayish or yellowish, nacreous slate similar to that seen near N. W. River of Clode Sound, were seen to underlie the graywacke in such manner as to lead to the conclusion that the latter, with the accompanying dark-green chlorite slate, forms the uppermost portion of the series.

About midway between Terra Nova River and Maccles Pond they are again seen to rest upon a belt of dark grayish and greenish,

coarsely-crystalline pegmatite. It contains large crystals of flesh-red and pink feldspar in a ground mass of grayish and greenish hornblendic material, with little or no quartz or mica. Some portions of this rock would prove a very handsome ornamental material.

Slates, &c., of the same general character now occupy a large extent of country northward, and at Maccles Pond the light-colored nacreous varieties are well displayed. Several minor intrusive masses intersect them at intervals along the railway track. On the shores of Maccles Pond, for the first time, their downward extension is met with. The nacreous slates and graywackes appear to merge gradually into a regular mica schist and gray, micaceous gneiss, with interstratified chloritic bands, all in turn resting upon coarsely-crystalline gray granite, which is partly interbedded with the gneiss. So far as could be ascertained, there appeared to be no break or want of conformity between the gneiss, mica schist, nacreous and chloritic slates and graywackes.

In the vicinity of the Gambo River mica schists and gray gneiss, forming the base of the formation, prevail. One belt of coarse granite, similar to those above described, comes to the surface about five miles south of Gambo. It is flanked on either side by the gneiss and mica slates, which strike up the valley of the Gambo, resting again upon a wide belt of granite near the head of the upper lake. Another tongue-shaped belt of granite rises near Mint Brook on the north side of the Lower Gambo Lake, and strikes thence eastward along the north side of the river out to the salt water near Middle Brook, occupies the whole north side of Freshwater Bay, including Hare Island. It is probably the same belt which spreads out eastward and extends over the country on the north side of Bonavista Bay, forming the point of land between it and Sir Charles Hamilton Sound, of which Cape Freels is the extreme eastern point. It varies much in character throughout its strike from comparatively fine-grained vitreous granite to coarsely-crystalline pegmatite maintaining generally a flesh-red colour. Numerous veins or dykes of fine felsite and dark-grayish hornblendic syenite traverse the mass running in all directions. Many portions of these granitoid rocks would yield handsome and durable building material.

Steel-gray micaceous slate and graywacke, come in merging into bulish chloritic on to the north of this belt on the

line of the railway towards Butt's Pond. Pale, pinkish veins of felsite occasionally cut these slates or run parallel with the bedding, while quartz veins are numerous. About a mile beyond Butt's Pond a few irregular, lenticular masses of bottle-green serpentine weathering yellowish brown, and reticulated by thin, thread-like strings of asbestos, protrude through these slates and appear to conform with the strike of the strata generally. This was the only true serpentine met with during the season, though many of the chloritic slates have a decidedly serpentinous aspect.

On approaching the eastern end of Gander Lake the mica slates are finally separated from another quite different set of strata by a wide belt of granite. Each, from its position and strike, would appear to be a continuation of that which crosses the head of the Upper Gambo Lake.

There appears little room for doubt that the rocks described above as occupying such an extent of country from the head of Trinity Bay to Gander Lake belong to one geological system, whatever that may be. It has already been shown that they hold an inferior position to the Huronian sandstones at Clode Sound, while they certainly possess little in common with the typical Laurentian, except it be in the micaceous and gneissoid strata near the base of the series.

Hitherto, from mere cursory observation at remotely-separated points, they had been considered as partly Laurentian and partly Huronian, and were classed as such in the absence of more decided evidence to the contrary. The more close and extended investigation of the past season, however, will scarcely now admit of such a classification. All the evidence gathered would seem to point to a different conclusion. The prevailing chloritic and sericitic character of a large portion of the rocks, the presence of jaspilites, breccias, volcanic tuffs, and the decidedly basic character of most of the intrusive masses, all bear a strongly-marked lithological resemblance to the Keewatin series of the Canadian and United States geologists. Then, again, their intermediate position between the Huronian and Laurentian systems is so clearly defined that we must, for the present at least, regard them as the equivalent of that great series. Mr. Andrew C. Lawson, of the Dominion Geological Survey, was, I believe, the first to describe and give this

distinctive appellation to a great belt of schistose rocks occupying the Lake of the Woods region, examined by him in 1883.

Mr. Lawson then pointed out the very marked difference between the almost exclusively sedimentary character of the Huronian strata and the very decided volcanic origin of at least a large percentage of his Keewatin series. These differences are well marked in the rocks we have been considering above. The term Keewatin has taken hold, and is now generally applied by the United States geologists, especially in Minnesota, to designate a large section of the celebrated iron-bearing rocks of Lake Superior and Northern Michigan. The Tower and Ely mines in this formation are two of the largest producers of iron in the United States, the Hematite ores therefrom being classed as some of the very best iron ores in the world. Gold has been discovered in this same series near the Lake of the Woods, and the Sultana mine is at present a profitable investment, while several others give fair promise of like results. These are facts worthy of the consideration of mining prospectors in this country, as there is no reason why similar results may not follow upon intelligent and systematic investigation and the judicious investment of capital here also.

The granitic belt near Gander Lake, already referred to, is about two miles wide. It is chiefly composed of rather large crystals of pale, flesh-colored and white feldspar, vitreous quartz and a fair sprinkling of black mica. The feldspar greatly predominates, giving a very handsome appearance. The Messrs. Reid have established a quarry here, from which they have raised a considerable quantity of excellent building material, which they have used extensively in the construction of piers and bridge abutments, for which purpose it has proved admirably adapted. They have also a considerable bulk of the same material ready dressed now on the ground, which, I understand, was contracted for by the Government to be used in the reconstruction of some of our public buildings in St. John's. It will present a very beautiful appearance, and afford a pretty contrast either to brick or freestone. The rock has a natural jointage in its bed, which greatly facilitates the work of quarrying and raising to the surface, and is not extra hard to dress.

Immediately to the north of this granitic belt a set of bluish-gray sandstones and quartzites, overlaid by a bluish, silky slate, the latter often peculiarly mottled, passing into a very black pyritifer-

ous slate towards the top, are met with. All these rocks are intersected by numerous small quartz veins, some of which hold considerable quantities of iron pyrites, both ordinary and magnetic (pyrrhotite), thickly disseminated in minute crystals. The black, pyritiferous slates are particularly much impregnated with these metallic ores, and are usually coated on the exposed surfaces with oxide of iron, resulting from the decomposition of the pyrites, which gives them a highly mineralized appearance.

They bear little resemblance to the rocks previously described. They are in a much less altered condition, and their general lithological and mineral characteristics would seem to point to a higher horizon in the geological scale. Their relation to the lower series by actual contact was nowhere observed.

On the shores of Gander Lake and near the crossing of the outflowing river bluish and grayish silky slates, merging into black, pyritiferous shales, with occasional thin, arenaceous layers interstratified, are the prevailing rocks. Some of the slates are peculiarly mottled, and often display a rough, warty surface. Numerous quartz veins intersect them in all directions, and some of the shaley bands are very pyritiferous, containing lumps and small masses of radiated pyrites. The mineral also occurs in thin, stratified layers. A little to the west of Glenwood, at the Gander River, and in the vicinity of Salmon River Bridge, low outcrops of finely micaceous, red sandstone, underlaid further on by red, flaggy or slaty bands, are seen, apparently occupying an inferior position to the silky, blue slates. These would seem to be conformably related to the latter and to constitute the lowest portion of the series. Similar sandstones, with a very coarse conglomerate at the base, occupy the lower valley of the Exploits River, where they are again found to underlie bluish and black, ferruginous slates, sandstones and fine conglomerates, which strike up the valley towards Red Indian Lake, and from thence reach nearly across to the south side of the island. A few fossils were found in these near the mouth of the river, while amongst the black, plumbaginous slates at Little Red Indian Fall, fifty miles up stream, some Graptolites of the genus *Namosus* occur. The late Mr. Billings, Palæontologist of the Dominion Survey, pronounced these organisms Middle and Upper Silurian. Numerous fossils of the same occur on

the Indian and New World Islands in Notre Dame Bay in almost similar strata.

These facts give ground for the supposition that all the slates, of these two great river valleys are in all probability of Silurian age, and apparently not at the very base of that great system. Nothing bearing a resemblance to the sericitic slates, graywackes, traps, &c., of the Keewatin series was met with on either of the river valleys of the Gander or Exploits or further west.

From the junction of the Badger with the Exploits where the line begins to turn westward till reaching the valley of Rowsell's Brook for a distance of about eleven miles the rock exposures are chiefly pyritiferous black slate and hard, bluish sandstone or quartzite. They become considerably disturbed and altered towards Lake Bond, and dioritic intrusions are of frequent occurrence. Heavy, bluish quartzites, blue, slate, and occasional dull, red jaspery bands, all much disturbed, crop out along the south side of Lake Bond. At the crossing of the first branch of Rowsell's Brook they come in contact with a great belt of greenstone which strikes up the valley in the direction of Skull Hill, which is evidently a boss of the same material. Some of the trappean intrusions are of a dioritic character and are often impregnated with minute crystals of iron pyrites and magnetic iron ore. A few quartz veins cutting the black slates contain specks of brilliant copper pyrites. Epidote intermixed with the jaspery bands, is not uncommon near the base of the series.

Though much altered and disturbed, especially towards their western limits, these slates and quartzites are all apparently part of the same great series which occupies the whole Exploits Valley, and must therefore, at least for the present, be classed as Silurian.

From Rowsell's Valley to the height of land, a distance in a straight line of fifteen miles, the whole aspect of the country changes. As has been shown, timber becomes scarce and stunted, and extensive marshes and barrens supervene.

The underlying rock formation, which usually plays such an important part in the character of the superficial deposits and the vegetation supported thereon, is in this case no exception to the rule. All the outcrops over this extensive area are of a granitoid nature and present a variety of rocks, from fine, felsitic dykes to massive, coarse-grained granite, ranging in colour through all

shades of red and gray. One small outcrop only, at the crossing of Mary March's River, which exhibits distinct lines of stratification and consists of a reddish quartzite with thin, ribbon-like layers of pale-blue cherty slate standing vertically, is an exception. It probably represents some portion of the preceding sedimentary series in a highly altered condition.

Numerous boulders of the country rock are strewn all over this section, indicating a vast amount of denudation. They are chiefly granitoid, but some partake of a porphyritic structure, and trap greenstones form a considerable percentage of the whole, though this rock was not seen in place in the immediate vicinity of the railway line. Amongst the many varieties of granite met with several beautiful, ornamental stones occur, while ordinary building material is abundant. Mr. Reid had established a quarry on the eastern slope of the Three Topsails ridge, from which much of the material used in the construction of his bridge piers west of the Exploits River crossing was obtained. The rock is a peculiar greenish-gray syenite in massive beds, which was found to cleave readily in any desired direction, affording an easily-wrought material which dressed with little difficulty into any shaped block required. Though a handsome stone when freshly quarried, I am of opinion it will not hold its colour; the presence of a great deal of magnetic iron disseminated through the rock in minute crystals is apt to decompose when exposed to the weather and cause discolouration. A very handsome, red granite, in thick, horizontal beds, occurs on Rowsell's Brook, a few miles north of the line. It greatly resembles the Peter Head granite of Scotland. A beautiful rose-pink variety crops out on the track near the Gaff Topsail, and a very peculiar, yellowish variety is seen also near the same point. The Topsails themselves are composed of rather coarse, grayish syenite.

Westward of the Gaff Topsail no rock is exposed near the line till reaching the forks of Kitty's Brook. Here a fine closed-grained reddish syenite crosses the Brook. A similar rock is exposed in one or two places on the Brook further down and at the Fall forms precipitous cliffs of fifty or sixty feet in height. Immediately below the Falls they are overlaid by rocks of the Carboniferous Series which have been fully treated of in the reports for 1891-92.

It was a marked feature of this great granitic belt that while

the central area was usually occupied by the coarsely-crystalline true granites they appeared to merge into finer-grained more felsitic, microgranites or syenites towards the borders on either side. The green-stone trap intrusions were evidently chiefly confined also to the eastern slope of the range—no rock of this character having been observed at all west of the Gaff Topsail. No distinct evidence of stratification could be detected in this great granitoid region, unless certain alternations of reddish and grayish syenite near the borders of the mass could be considered as such. Again, the alternations of the different varieties of granite may point to a sedimentary origin. Hitherto this belt of archæan rocks which forms the Long Range Mountains, extending through the entire length of the island from Cape Ray to the northern extremity, and which is here crossed by the western branch of the railway, has been regarded as the equivalent of the Lower Laurentian system. No evidence which would warrant a contrary opinion has been obtained during the past season's investigation.

GLACIATION.

A few notes on the glaciation of the country traversed will afford some idea of the enormous erosion which has taken place in this island during a period of its history when the entire surface must have been covered by a moving mass of ice, the action of which mighty force has tended in no small degree to mould it into its present contour. I shall not here attempt any elaborate theorizing upon this interesting phenomena, but shall merely confine myself to a statement of actual facts observed during the season and the deductions to be gathered therefrom. That the entire face of the country has been subjected to profound and long-continued ice-action which has resulted in wholesale denudation of the fundamental rock material forming its solid crust, is everywhere most apparent. The immense profusion of boulders of all shapes and sizes, the rounded outline of the hill-ranges, the deeply grooved striated and frequently polished surfaces of the rock exposures, all bear most unmistakable testimony to the passage of a detritus-laden ice mass apparently of gigantic dimensions and weight.

The direction of the grooves and striae though occasionally effected by local circumstances is, on the whole, pretty uniform, and points clearly to a main movement from the westward toward the

eastward, varying only a few points throughout. South of the Gander River Valley the main direction is about twenty degrees south of east, but after passing it, especially on the Exploits River and all over the height of land, the prevailing direction is a little north of east, or N. 80 degrees E. magnetic.

In confirmation of the above, it was noticed that much of the worn boulder debris scattered along the route of the railway was not characteristic of the formations lying to the eastward near the sea coast, but in many instances resembled those known to occur inland, westward from the line. The frequent occurrence of roche moutonnees, sometimes as low island rocks in the lakelets, but more frequently as isolated knolls or peaks—the latter, when more than usually conspicuous, being known locally as “toits”—give ample evidence on this point. Invariably all these present a gradually inclined surface towards the south-west, west and north-west, while the opposite sides are usually abrupt. On Maccles Lake, Terra Nova Lake and the Exploits River several such low island rocks occur all well worn and grooved. Such prominent peaks as Mount Peyton near Gander Lake, Hodge's Hill near Badger River, Skull Hill in Rowsell's Valley, the Three Topsails at the height of land, and the Gaff Topsail near Kitty's Brook—all bear out the same supposition. In the case of the Topsails, which crown the highest summit of the Long Range Mountains where the line crosses them, it would appear as though they protruded partly through the ice-cap or were surrounded by it, as the sides of these toits are equally well worn and grooved with the top. The Mizzen Topsail, the most westerly of the three and occupying the highest point of the ridge, exhibits in a marked manner the mighty force which had been exerted in uplighting and removing from its bed the massive granite of which it is composed. Huge fissures intersect the rock in several directions, crevices extending down out of sight, indicate where cleavage joints had been acted upon by water penetrating the cracks and then subjected to intense frost causing the blocks to be forced asunder. Many large masses of granite thus wedged out, as it were, lay piled at the base of the tolt—their very angular character proving that they had not been far removed. One or two huge, oblong, angular fragments lay on the summit directly across the open fissures, as if they had been merely lifted from their position and lodged on the top of the hill. Many such

immense fragments of granite are scattered over the lower levels near by, exhibiting various degree of abrasion, according to the distance they had been transported and the amount of friction they had been subjected to. All the smaller and medium-sized boulders are usually well worn, often striated, when the material was such as to retain these markings distinctly. These same remarks apply to all the parts of the country examined and would seem to indicate that the higher elevations were the seat of the glacier movement which in that case would be purely of local origin.

The lower levels of the country have in all cases received the bulk of the worn disintegrated detritus from the highlands, which is met with in all directions. Immense accumulations of boulders, often piled rampart-like upon each other, may be seen on the shores of some of the lakes, such as Terra Nova and Maccles Pond, always on the north and east sides; again on the river banks, particularly on the Exploits, walls of piled boulders frequently extend many hundred yards along the eastern bank of the river. Similar ramparts of boulders were observed in the Peninsula of Avalon in 1872 on the shores of several lakes and the islands therein. They might almost be mistaken for fortifications erected by the hands of man. A few good instances of perched boulders were observed, one especially on the shores of Maccles Pond, where four large blocks of granite of different character rested on the summit of a well-rounded boss or dome of solid rock. Two of them occupied the very apex of the dome, while the other two, owing to the small space, were resting partly on the inclined sides in such manner that one could imagine a slight push would be sufficient to dislodge them.

The fine material, consisting of coarse gravel, sand and clay, which has been pushed furthest forward by the ice foot or lodged along the sides of each separate stream of moving ice in the form of lateral moraines, as may reasonably be expected, occupies the numerous rivers and valleys, or is found piled up near the heads of the arms or indentations of the sea coast. Evidently on approaching the sea, the ice mass gradually melted or became separated by cracks and fissures into several smaller streams, each of which was given direction by the prevailing features of the country. The numerous, deeply-cut ravines forming the valleys of the lesser

streams which flow into the various arms or fiords of the eastern coast-line, all bear evidence of having been ploughed out by such branches or deviations from the main flow. The grooves and striæ are found to coincide with the trend of the valleys in each instance, following their various meanderings till they reach the sea. When more than usually deep and narrow and bounded by hard, crystal-line rocks, the striæ and polishing extends up the side slopes to and over their summits. Numerous small, lateral currents seem to have joined the larger ones wherever a depression exists in the hills, all exhibiting grooves and striæ, indicating the direction from whence they came.

The accumulation of mixed sand, gravel and till along the sides and in the bottoms of these ravines is sometimes enormous, especially near their exit into the sea. Occasionally they exhibit a rude arrangement resembling stratification. One heavy gravel cut near the mouth of the Gambo River, at the head of Freshwater Bay, is a good example of this. Near Terra Nova River, just where the railroad line crosses, a series of low, rounded mounds of fine sand were the best sample of kames met with. The following record of the grooves and scratches observed during the season at various points along the route of the N. and W. Railway, will tend to bear out the suppositions set forth above as regards the general direction of the ice movement:—

LOCALITY AND DIRECTION OF ICE GROOVES AND STRIÆ.

Near Tickle Harbor crossing, Peninsula of Avalon, N. 80 degrees E., magnetic;

In valley Lower Shoal Harbor River, Trinity Bay, S. 50 degrees E., magnetic;

Near crossing Shoal Harbor River, S. 44 degrees E., magnetic;

Near Camp Pond, three miles beyond, S. 63 degrees E., magnetic;

At outlet from Thorburn Lake, S. 65 degrees E., magnetic;
A little beyond, S. 88 degrees E., magnetic;

On outflowing brook, S. 65 degrees E., magnetic;

Head of Thorburn Lake S. 70 degrees E., magnetic;

S. S. valley of S. W. River, Clode Sound, S. 70 degrees E., magnetic;

About $\frac{1}{4}$ -mile beyond N. W. River bridge, Clode Sound, S. 70 degrees E., magnetic;

On Island Rock, Terra Nova Lake, S. 67 degrees E., magnetic;

On Island Rock, Maccles Pond, S. 80 degrees E., magnetic;

Near Lit. Pond, foot Maccles Pond, S. 80 degrees E., magnetic;

On curve seven miles south of Gambo, S. 65 degrees E., magnetic;

Near 170th mile, or nine miles beyond Gander River, N. 80 degrees E., magnetic;

Three and a half miles west of Badger River, N. 80 degrees E., magnetic;

At the 231st mile, head of Lake Bond, N. 80 degrees E., magnetic.

The coarser granites, &c., occupying the height of land or Long Range, though all worn and grooved, are not such as to retain the striæ sufficiently distinct to enable one to ascertain their exact direction, but the other evidence advanced leaves little doubt that they coincide generally with the above.

ECONOMICS.

Gold.

Though no actual finds of visible gold were made during the exploration many circumstances seem to favour the great probability of gold being found as an economic product of this section of country at no distant period. It has long been known to occur in small quantities in quartz veins cutting the older Huronian slates near Briggs in Conception Bay. Distinct traces of this precious metal were ascertained in a quartz vein cutting the silky, bluish slates on the S. W. branch of the Gander River in 1876.

The innumerable quartz veins observed all along the route of the railway, but especially near Clode Sound, Thorburn Lake, N. W. River, Terra Nova River, Maccles Pond, Gambo, Butt's Pond, Suley's Brook and Gander Lake, frequently look very promising for gold, particularly those cutting the Keewatin schists. This same series in Canada has been proved to be auriferous, and in the Lake of the Woods district, where much prospecting has been carried on of late years, paying gold mines are now established. Two at least of the numerous finds in that district, the Sultana and

Gold Hill mines, are now giving profitable results. Should intelligent prospecting, followed up by the judicious expenditure of capital and directed by a thorough knowledge of gold-mining, be ever brought to bear in this direction, I have little doubt the result will some day bear out the supposition that gold-mining will become one of the industrial resources of the island.

Nickel.

The frequent mention of the occurrence of magnetic pyrites (Pyrrhotite), though in small quantities only, is significant. This mineral does not afford much iron of value, nor can it ever take the place of the ordinary pyrites as a sulphur-producing ore, but the frequent presence of nickel in greater or less quantity associated with it is a matter of very great import. The now celebrated nickel mines of the Sudbury district, north of Georgian Bay, Lake Huron, yielded, according to the Canadian mining statistics for 1890, nickel to the value of \$933,232. The ore producing this metal is a nickeliferous pyrrhotite, which yields on an average about 3.52 per cent. nickel, while it ranges from 2 to 5 per cent. Though no large repositis of this mineral were met with last season, its presence in small quantities, chiefly disseminated through quartz veins at several points along the line, should prove an incentive to search for the ore. Large deposits occur in several places around Notre Dame Bay especially in association with some of the copper ores. A suspicion of their nickeliferous character induced me last winter to send a few specimens of these ores to Canada to have them tested. Through the kindness of Dr. A. R. C. Selwyn, the then Director of the Dominion Survey, they were submitted to the Assayist of the Survey and returned. The result showed the presence of nickel in small quantity in each specimen, and though not sufficient to make the mining of the ore remunerative, should at least be an inducement to mining prospectors to look more closely after this class of ore, hitherto totally neglected.

The following are the assays referred to, the percentage of nickel given being in proportion to the whole mass of the specimen both rock and ore:—

- No. 1 Nickel: 0.33 per cent. cobalt trace;
- No. 2 Nickel: 0.14 per cent. cobalt trace;
- No. 3 Nickel: 0.08 per cent. cobalt trace.

In the first of these the gangue constituted 1.03 per cent. of the whole specimen; in the second 15.00 per cent., while the metalliferous portion of the ore contained 0.16 per cent. nickel. In No. 3 the gangue reached 40.15 per cent. by weight of the whole specimen, the metalliferous portion containing 0.13 per cent. nickel.

Copper.

Copper pyrites in small quantities was met with at several points along the line, usually in quartz veins. At Lower Shoal Harbor, Trinity Bay, beautiful peacock ore, erubescite, was seen to impregnate a quartz vein, but not in sufficient quantity to be of economic importance. Gray copper, tetrahedrite, was also met with in a cutting near Thorburn Lake; also in quartz sparsely distributed. These and other instances are merely mentioned to show the presence of this mineral in the rocks. Possibly it may occur in some part of the region in a more concentrated form and in sufficiently large deposits to be available for mining. Several years since, a very fine, rich specimen of copper was picked up loose on the Gander River below the Lake, but the locality from whence derived has never been ascertained. The occurrence of serpentine near the Gander Lake, and again in large volume on the upper reaches of the Gander River above _____, might be looked upon as a favourable augury for the presence of copper and other valuable metallic substances as likely to occur in association therewith. Nothing short of a systematic prospecting of the country by experienced miners will ever reveal the presence of valuable deposits of such ores.

Iron Ores.

Magnetic iron in crystals, pretty thickly dispersed throughout the rock, occurs in a coarse diorite near _____ Harbor, Trinity Bay. The same ore was seen in minute crystals in other finer-grained diorites west of Badger Brook, and also as one of the accessory minerals in several of the granitic rocks met with. No well-defined vein or lode of this ore was discovered anywhere. A wide belt of dull, earthy, reddish jasper containing much ferric oxide, occurs near Clode Sound, as already mentioned. Though not in itself sufficiently rich in metallic substance to prove of much value, nevertheless it is accompanying just such jaspilites, and in about the same horizon, that the Minnesota iron ores,

famed for producing some of the best iron in the world, are wrought. The abundant indications of the presence of iron in this rock are sufficient to warrant a close search here for Hematite ore, which, I imagine it is exceedingly probable, will some day be found to accompany the jaspers. On the north side of Smith's Sound a very black-weathering calcareous band occurs, which, from its great specific gravity, appeared to contain much oxide of iron also. Iron ores of good quality are becoming much sought after of late years. The possession of numerous deposits of such ores in a country like this, which affords such facilities for mining and shipping the same, especially when situated near the sea-coast, should prove of immense importance to the mining development of the future. The recent discovery of a valuable deposit of Hematite iron on the Great Bell Island in Conception Bay has attracted the attention of outside capitalists, with the result that a company has been formed to work the ore, having first thoroughly tested the extent and quality of the deposit. I have not had the opportunity of visiting the location as yet, but from all I can learn the mineral forms a regularly stratified layer of the formation, which is Upper Cambrian, or possibly at the very base of the Lower Silurian Series. It averages about twelve feet in thickness, and spreads over a considerable area of the island—being situated quite close to the surface and cropping out in the sea cliff on the north-east end of the island. It affords every facility for mining and shipping to advantage. Already the company have constructed a tramway across to the south side of the island, and have erected a pier and loading apparatus at a convenient point on the shore. I understand active operations will be commenced almost immediately.

The following analysis of the ore has been kindly furnished me by the owners of the property, Messrs. Shirran & Pippy, of St. John's. Analysis of Hematite Ore from Great Bell Island, Conception Bay, by G. T. Holloway, F. C. Sa.:—

Iron, 62.7 per cent., corresponding to sesquioxide of iron	
(Fe. 2; O. 3)	89.57
Silica (Si. O. 2)	8.30
Phosphoric Acid (P. 2; O. 5)	0.398
Sulphuric Acid (S. O. 3)	0.062
Alumina (Al. 2; O. 3)	0.13
Lime (Ca. O.)	trace.

Magnesia (Mg. O.)	trace.
Carbonic Acid (C. O. 2)	nil.
Manganese Oxide	0.55
Moisture and combined water	1.21
	100.22

Bog-iron ore was met with in considerable quantity on the high land near Patrick's Brook. It forms a thin layer underneath the peaty coating of the marshy grounds, and is well seen in some of the side-drains along the line where the peat has been removed. This class of ore, when pretty rich in iron and free from earthy impurities, is a most valuable one. In Canada the pig-iron produced therefrom is largely used in the manufacture of locomotive car wheels, for which purpose it is admirably adapted.

Iron Pyrites.

The well known chemical uses of this ore and its adaptability to the manufacture of sulphuric acid need not be entered upon here. It is one of the most common and abundant mineral substances in this country. Though no actual deposits of an extensive character were met with the past season, this mineral was found pretty generally disseminated in all classes of rock, usually in the form of fine crystals impregnating the quartz veins, diorites, &c. Several very ferruginous slate bands containing lumps and strings of radiated pyrites were observed along the line, as at Shoal Harbor, Trinity Bay, on Random Island, near Suley's Brook, at Gander Lake, and on the Exploits River. Some of the slates on Gander Lake were so filled with this mineral that it seemed almost sufficiently abundant to make it available for mining purposes. Possibly a close search in this neighborhood would reveal even more extensive deposits of the mineral in a concentrated form, comparatively free from rock material, such as that occurring in the well known Pilley's Island pyrites mine. The same remarks may be applied to the Exploits Valley, where the black slates are frequently well charged with the ore.

Manganese.

A very impure, earthy, brown-colored manganese was seen,

associated with limestone, in the valley of Shoal Harbor River. It occurs in a band of Lower Cambrian rocks similar to those holding manganese on the south shore of Conception Bay. Wad or bog manganese occurs sparingly, associated with the bog-iron ore, on the highlands west of the Exploits Valley. No ore of a valuable description was, however, met with.

Alum.

Alum one of the products derived from the decomposition of iron pyrites or rather from the action of the sulphuric acid set free thereby upon the alumina contained in the clay slates or shales, is of common occurrence amongst the more highly pyritiferous shales. On the western end of Random Island a very papyraceous black shale occurs, much impregnated with finely-disseminated pyrites. A white crust of alum in considerable quantity, frequently tinged yellow from oxide of iron, is seen coating the exposed edges. Much alum is produced from similar shales in Germany, France, England and the United States by a process of lixiviation.

BUILDING AND ORNAMENTAL MATERIAL.

Frequent reference has been made in the foregoing pages to the granites and granitoid rocks met with in such abundance at various points along the line, more especially over the high land of the Long Range Mountains. There is an infinite variety of these rocks, suitable for building, monumental and ornamental purposes. Some of the red sandstones and grits near Clode Sound would answer well for rough work. The rose-pink quartzite at this locality is a handsome rock, and might be readily dressed with the hammer into regular blocks, though it is too hard to be faced with tools. Some of the graywackes diorites, traps, &c., would afford good material for block pavements, macadamizing roads, streets, &c. The limestones of Smith's Sound, though unfit for building purposes and usually impure, would in some instances afford a good, strong lime, when burnt, for all ordinary purposes. The slates of this same locality have long been known and quarried but only in a small way. The material is of extra good quality, fully equal to the best Carnarvon slate, and should certainly be turned to better account were a little capital and judicious management brought to bear in the development of the quarries.

Slates of a similar character, to all appearances, were met with in the valley of Chapel Arm, at the head of Trinity Bay, not far from the railroad line in the vicinity of Placentia Junction.

Good honestones might be readily obtained from the schistose rocks along the line, especially amongst the mica schists and talcose slates referred to. Brick-clay occurs on several parts of Random Island and Smith's Sound. There is an immense deposit extending along the north side of the Sound. Here a brick-yard has been established for many years by a man named Pitman. He and his sons manage to make a fair living out of the brick manufactured, but it is only on a small scale. A much more elaborate attempt at brick-making has been started at Elliott's Cove on the south side of the island, where adequate machinery and skilled labor are brought to bear. The result is, I understand, proving fairly successful of late, though rather a failure at the outset from some unascertained cause. The material here is not so good or so abundant as at the former locality. Some of this clay is made up in the form of bricks unbaked and is shipped to St. John's to be used for moulding purposes at the founderies.

THE MUSEUM.

Many important additions have been made to the Museum since writing last report. They are as follows:—

Specimens of iron pyrites from Pilley's Island: Presented by A. Beatty;

Asbestos and Serpentine from Port-au-Port Asbestos Mine: A. M. White;

Block-dressed Granite from quarry near Gander Lake: R. G. Reid;

Native Sulphur, New Zealand: A. G. Williams;

Fossil Gum, New Zealand: A. G. Williams;

Manganese, Nova Scotia: W. E. Jennison, M.E.;

Amber-colored Calcite from Cape LaHune: W. J. Clouston;

Hematit., Bell Isle: A. F. Shirran;

Lithographic Stone, Parsons' Pond: G. A. Pippy;

Amethystine Quartz, Bonavista Bay: B. Kean;

Serpentine, Port-au-Port: H. H. Haliburton;

Manufactured products from Pilley's Island—Pyrites, mine consisting of: 1st, Sulphuric Acid; 2nd, Alum; 3rd, Iron (two qualities); 4th, Slag: The Pyrites Company;

Labradorite, Labrador: R. G. Tabor;

Asbestos, Port-au-Port; Capt. Cleary;

Asbestos, Port-au-Port: A. White;

Asbestos, Ming's Bight: A. O'Meara;

Fossils, Port-au-Port: W. A. B. Selater;

Magnetic Iron Ore, Ming's Bight: A. O'Meara;

A number of Rock and Mineral Specimens, principally Granite Blocks, Fossils, Brick-Clay, &c., have been added by The Survey.

NATURAL HISTORY SPECIMENS.

Small collection of birds' eggs and birds, Conn River: Gower Leslie;

Small collection of birds' eggs, Beaver Cove: E. S. Hennebury;

Sole and Flounder, Harbor Grace: Mat Martin;

Two saws of Sawfish: Bernard Dahl;

Newt: W. A. Ellis;

Bat, Broad Cove: John Squires;

Land-locked Salmon, Gambo: R. G. Rendell;

Two Catfish: William Loughlin;

Pollock, Thoroughfare, Trinity Bay: Stephen Leonard;

Young Lobsters: Aadolph Nielsen;

Two Lumpfish, Labrador: Capt. Blandford;

Flying Squirrel, Labrador: Rev. A. C. Waghorne.

MISCELLANEOUS.

Analysis of Fish Fertilizer: John Munn & Co.;

Bomb from site Central Fire Hall: Inspector Sullivan;

Copy of London *Sun* (Coronation Number): M. Meyers;

Eskimo (toy) Skin Boots: Miss Ethel Addy;

Old French Axe attached to root of tree, Placentia: W. A. B. Selater;

Rotary Spear Head, Africa: Jas. H. Cousins;

Eskimo Spear Head, Greenland: Jas. H. Cousins;

Old Coins of England, France, Spain, Sweden and United States: Robert Chauncey, Boston;

United States Coin (50 cents): E. J. Bell, Philadelphia;
Weather Charts, Little Bay, '94-5: Capt. G. Foote, M.H.A.;

Weather Records from 1884-90, taken at Cape Norman Light-house: Henry Lock.

A splendid collection of the Flora of Newfoundland has been presented to the Museum, through Rev. Dr. Harvey, by Prof. Robinson, of the Harvard University Herbarium. New cases have been set up to receive this beautifully arranged collection, which is a most valuable acquisition to the Museum.

Several specimens have been added by purchase during the past year, and a lot of new cases and fittings required from time to time to receive them. A number of new and interesting photographs of the scenery of the country, chiefly along the route of the Northern and Western Railway, taken during the past season, are now on exhibition. The interest taken in the Museum by all classes continues unabated.

During the past year the Government were pleased to adopt the suggestion of insuring the collection, so that now, in case of destruction by fire, the Colony will, to some extent at least, be recuperated for its outlay.

It is much to be regretted that, owing to the political and other changes of the past twelve months, the intention of forwarding an exhibit of all the natural resources of the island to the Imperial Institute of London was not carried out.

The intention of the Imperial Government as you are aware, is to bring together under one roof an economic exhibit of all the wealth of the Colonial Empire. Each colony is provided with a section giving to it a distinctive character while forming part of the whole scheme. Such an exhibition of Newfoundland's great natural resources could scarcely fail to attract the attention of the capitalist or investor to the undeveloped wealth of the Colony—the oldest, nearest and most easily-accessible of the vast Empire. I feel confident, were a sufficient sum placed at the disposal of the Survey to send a thoroughly representative collection in good shape, we should have much to feel proud of, and the good effect likely to be produced would amply repay for the outlay in course of time. If it only had the effect of dispelling the doubts existing outside the Colony regarding these resources, and upsetting the

prejudicial character of the many damaging reports sent abroad from time to time that in itself would be sufficient to warrant the comparatively small outlay requisite.

I have the honour to be Sir,

Your obedient servant,

JAMES P. HOWLEY.



